REMARKS/ARGUMENTS

Reconsideration of this application in light of the above amendments and following comments is courteously solicited. The invention as claimed in claim 1 is directed to a copper base alloy consisting of 8 to 45 wt% of zinc, 0.2 to 12.0 wt% of tin, 80 to 1000 ppm of carbon, and the balance being copper and unavoidable impurities, wherein a difference in temperature between liquidus and solidus lines is 30℃ or more.

The invention as claimed in the amended claim 2 is directed to a copper base alloy consisting of: 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; one or more elements which are selected from the group consisting of 0.01 to 0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, and 0.01 to 0.1 wt% of magnesium, and the balance being copper and unavoidable impurities, wherein a difference in temperature between liquidus and solidus lines is 30℃ or more.

The invention as claimed in the amended claim 19 is directed to a copper base alloy consisting of: 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; one or more elements which are selected from the group consisting of 0.01 to 0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, 0.01 to 0.1 wt% of magnesium and 0.0005 to 0.001 wt% of boron; and the balance being copper and unavoidable impurities, wherein a difference in temperature between liquidus and solidus lines is 30℃ or more.

The invention as claimed in claim 1 is directed to a Cu-Zn-Sn alloy (a copper base alloy containing Zn and Sn as essential elements) which contains a small amount of carbon, as described in Examples 1, 2 and 8. The Cu-Zn-Sn alloy may contain a small amount of at least one element selected from the group consisting of silicon, nickel, magnesium and boron, as described in Examples 3-7.

As is well known, brasses containing zinc in copper have

excellent characteristics, such as excellent workability and press punching quality and low costs, and are utilized as the materials of many electric parts, such as connectors. However, it is required to further improve the strength, spring characteristic, stress relaxation resistance and stress corrosion cracking resistance of brasses in order to cope with the miniaturization of parts and the deterioration of working environments. In such circumstances, there have been proposed methods for improving the above described characteristics by adding a predetermined amount of Sn to a Cu-Zn alloy.

Such a Cu-Zn-Sn alloy is formed as a plate having a predetermined thickness usually by a method comprising the steps of carrying out the longitudinal continuous casting, heating the obtained ingot by a heating furnace, extending the heated ingot by hot rolling, and thereafter, repeating cold rolling and annealing. Although the mechanical characteristics, such as tensile strength and 0.2% proof stress, stress relaxation resistance and stress corrosion cracking resistance of Cu-Zn-Sn alloys can be improved by the addition of Sn, it is desired to improve the hot workability thereof. That is, there are some cases where Cu-Zn-Sn alloys may be broken during hot rolling to deteriorate the surface quality and yields of products, so that it is desired to improve the hot workability of Cu-Zn-Sn alloys.

In order to obtain a Cu-Zn-Sn alloy having an improved hot workability, the inventors were diligently studied and found that it is possible to greatly improve the hot workability of a Cu-Zn-Sn alloy by causing the Cu-Zn-Sn alloy to contain a small amount of carbon. Then, the inventors have found some methods for efficiently causing the copper base alloy to contain carbon although it is difficult to cause the copper alloy to easily contain carbon since the degree of solid solution of carbon in copper is usually small and since the difference in specific

gravity between carbon and copper is great. By such methods, the inventors have made a novel copper base alloy consisting of 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; optionally one or more elements which are selected from the group consisting of 0.01 to 0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, 0.01 to 0.1 wt% of magnesium and 0.0005 to 0.001 wt% of boron; and the balance being copper and unavoidable impurities. Thus, the inventors have found that such a copper base alloy has a greatly improved hot workability.

Furthermore, it is described in Examples 3-7 that Cu-Zn-Sn alloys contain 0.2 wt% of silicon, 0.3 wt% of nickel, 0.1 wt% of magnesium, or 0.001 wt% of boron.

Claims 1, 20, 21, 26, 27, 29-31, 38-43, 47 and 50-51 were rejected under 35 U.S.C. §103 as being unpatentable over EP 0411882 or EP 0872564.

EP 0411882 discloses copper-base alloys consisting essentially of 5 to 30 wt% of Ni, 0.5 to 3 wt% of B, 1 to 5 wt% of Si, 4 to 30 wt% of Fe, at least one of 3 to 15 wt% of Sn and 3 to 30 wt% of Zn, and the reminder being Cu and unavoidable impurities.

The copper-base alloys disclosed in EP 0411882 are copper-base alloys containing relatively large amounts of Ni, B, Si and Fe in addition to Sn and Zn as essential elements, and the contents of Ni, B, Si and Fe in the copper-base alloys disclosed in EP 0411882 do not overlap with those in copper base alloys as claimed in the pending claims, so that the copper-base alloys disclosed in EP 0411882 are quite different from copper base alloys as claimed in the pending claims.

Therefore, EP 0411882 fails to disclose or suggest any copper base alloys consisting of 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; optionally one or more elements which are selected from the group consisting of 0.01 to

0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, 0.01 to 0.1 wt% of magnesium and 0.0005 to 0.001 wt% of boron; and the balance being copper and unavoidable impurities.

EP 0411882 also discloses that C is added to form carbide hard particles which further increase the wear-resistance. However, EP 0411882 fails to disclose or suggest that the hot workability of a Cu-Zn-Sn alloy, which is deteriorated by adding Sn to a Cu-Zn alloy, can be greatly improved by causing the Cu-Zn-Sn alloy to contain a small amount of carbon.

EP 0872564 discloses copper based alloys consisting essentially of 15 to 35 wt% of Zn, 7 to 14 wt% of Ni, 0.1 to 2 wt% of Mn, 0.01 to 0.5 wt% of Fe, 0.0005 to 0.1 wt% of P, at least one element selected from the group consisting of 0.001 to 0.9 wt% of Si, 0.0003 to 0.02 wt% of Pb, and 0.0003 to 0.01 wt% of C, the total content of the selected at least one element being limited to a range of 0.0006 to 0.9 wt%, and the balance of Cu and inevitable impurities.

The copper based alloys disclosed in EP 0872564 are copper based alloys containing a relatively large amount of Ni and predetermined amounts of Mn, Fe and P as essential elements, and the contents of Ni, Mn, Fe and P in the copper based alloys disclosed in EP 0872564 do not overlap with those in copper base alloys as claimed in the pending claims, so that the copper based alloys disclosed in EP 0872564 are quite different from copper base alloys as claimed in the pending claims.

Therefore, EP 0872564 fails to disclose or suggest any copper base alloys consisting of 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; optionally one or more elements which are selected from the group consisting of 0.01 to 0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, 0.01 to 0.1 wt% of magnesium and 0.0005 to 0.001 wt% of boron; and the balance being copper and unavoidable impurities.

EP 0872654 also discloses that C is added to increase the rupture section ratio of the blankout section to reduce the amount of wear of the blanking die. However, EP 0872654 fails to disclose or suggest that the hot workability of a Cu-Zn-Sn alloy, which is deteriorated by adding Sn to a Cu-Zn alloy, can be greatly improved by causing the Cu-Zn-Sn alloy to contain a small amount of carbon.

Claims 1, 2, 19, 21-25, 27-37 and 41-52 were rejected under 35 U.S.C. §103 as being unpatentable over JP 60036638 in view of EP 0411882 or Hansen.

JP 60036638 discloses Cu alloys comprising 0.01-15 wt% of Ti and 20-99.99 wt% of Cu, the Cu alloys containing 0-7 wt% of Fe, 0-50 wt% of Zn, 0-15 wt% of Al, 0-10 wt% of Sn, 0-5 wt% of Pb, 0-5 wt% of Mn, 0-5 wt% of Be, 0-1 wt% of As, 0-0.5 wt% of C, 0-5 wt% of Co, 0-3 wt% of Cr, 0-3 wt% of Ag, 0-0.5 wt% of O, 0-0.2 wt% of S, 0-0.3 wt% of Bi, 0-0.3 wt% of Cd, 0-1 wt% of Zr, 0-1 wt% of Sb, 0-2 wt% of Te, 0-1 wt% of Ca, 0-1 wt% of Mg and 0-1 wt% of Li.

The copper alloys disclosed in JP 60036638 are copper alloys containing Ti as an essential element, and the content of Ti in the copper alloys disclosed in JP 60036638 does not overlap with that in copper base alloys as claimed in the pending claims, so that the copper alloys disclosed in JP 60036638 are quite different from copper base alloys as claimed in the pending claims.

None of JP 60036638, EP 0411882 and Hansen discloses or suggests any copper base alloys consisting of 8 to 45 wt% of zinc; 0.2 to 12.0 wt% of tin; 80 to 1000 ppm of carbon; optionally one or more elements which are selected from the group consisting of 0.01 to 0.2 wt% of silicon, 0.01 to 0.3 wt% of nickel, 0.01 to 0.1 wt% of magnesium and 0.0005 to 0.001 wt% of boron; and the balance being copper and unavoidable impurities.

In addition, none of JP 60036638, EP 0411882 and Hansen discloses or suggests that the hot workability of a Cu-Zn-Sn alloy, which is deteriorated by adding Sn to a Cu-Zn alloy, can be greatly improved by causing the Cu-Zn-Sn alloy to contain a small amount of carbon.

Therefore, it would not have been obvious to one of ordinary skill in the art to make any copper base alloys as set forth in the amended claims and other pending claims.

Accordingly, it is believed that the amended claims and other pending claims patentably distinguish the invention from the prior art.

An earnest and thorough attempt has been made by the undersigned to resolve the outstanding issues in this case and place same in condition for allowance. If the Examiner has any questions or feels that a telephone or personal interview would be helpful in resolving any outstanding issues which remain in this application after consideration of this amendment, the Examiner is courteously invited to telephone the undersigned and the same would be gratefully appreciated.

It is submitted that the claims as amended herein patentably define over the art relied on by the Examiner and early allowance of same is courteously solicited.

If any fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

Respectfully submitted,

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Date: June 7, 2007